Chapter 5

Gulf Coast Regional Climate

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5.1 General Climate of the Gulf Coastal States

Alabama

Alabama has a mild climate. January temperature averages about 52°F in the southern part of the state, and about 46°F in the north. July temperatures average about 80°F throughout the state. Alabama's annual precipitation averages from about 65 inches on the coast to 53 inches in the north. Snow falls in the north, but is rare on the coast.

Florida

Most of Florida has a warm, humid climate similar to that of the other southern states. Florida's southern tip has a tropical wet and dry climate like that of Central America and large parts of Africa and South America. Nearly all of Florida's precipitation occurs in the form of rain. Florida has an average yearly precipitation of 54 inches. An average of 32 inches falls in the rainy season, which lasts from May to October.

Louisiana

Most of Louisiana has a hot, humid, subtropical climate. It is one of the wettest states, with a yearly average of 57 inches of precipitation. Southern Louisiana has an average January temperature of 55°F, and a July average of 82°F. Hurricanes sometimes strike the coastal areas of Louisiana, causing loss of life and damage to property.

Mississippi

Mississippi has a warm, moist climate with long summers and short winters. In July, Mississippi temperatures average about 81°F. Winds from the Gulf of Mexico and frequent thundershowers cool much of the state during the summer. January temperatures average 46°F in Mississippi. Mississippi's precipitation ranges from about 50 inches a year in the northwestern part of the state to about 65 inches in the southeast. Hurricanes sometimes sweep northward from the Gulf in late summer and fall.

Texas

The climate of Texas ranges from subtropical in the lower Rio Grande Valley to moderately temperate in the northwest. Along the Gulf of Mexico the coast has a warm, damp climate. There, winds from the Gulf reduce the heat of summer and the cold of winter. Rainfall in Texas decreases from east to west. East Texas averages 46 inches of precipitation a year. Part of west Texas averages only 12 inches a year.

5.2 Observed Regional Climate Trends

The Gulf Coast regional temperature over the 20th century, according to data from the United States Historical Climatology Network data set (Easterling et al., 1996) increased from the turn of this century until the 1950s, when a significant cooling took place. Since that time a general warming trend has been established again. The largest warming during the last century in the Southeast of the US has occurred along the Gulf Coast region. Much of the warming since the 1950s has occurred in winter (Fig 1).

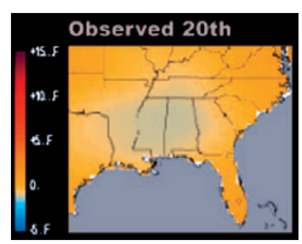

Figure 1. Observed 20th century temperature trend in the Southeast and the Gulf Coast region of the US. The largest warming during the last century has occurred along the coastal region. From NAST, 2002.

Over that same time period, the annual precipitation has increased some 20-30% and the past ten years appear to be getting wetter (Fig 2). Dating back to 1895, the wetness during the 1990s were clearly noted (Fig. 3). Data for 1997 from the National Climate Data Center indicated record wetness in many parts of the Gulf Coast region, enhanced by the strong El Nino event (Fig 4).

The El Nino event which has been creating anomalous weather in many parts of the globe contributed to 1997 being the warmest year of the century taking into account land and sea surface temperatures. El Nino has also contributed to the excess moisture along the Gulf Coast region. The Gulf Coast region precipitation departured for 1997 from 1961–90 normals is consistent with El Nino projection.

Many of the regional climate change findings over the past five to ten years can be summarized as followings (Crowe and Quayle, in Ning et al. 2000):

- Temperatures are increasing.
- Regional temperature changes are several times larger than the global average:
  Daily minimum temperatures are increasing at twice the rate of maximum temperatures and several times the rate of global temperature increase.

  Increase for minimum is 1.5° F since 1950 (0.7° F for maximum).
- There is evidence for an enhanced hydrologic cycle:

  Decrease in daily temperature range

  More atmospheric water vapor

  More precipitation

  More intense precipitation events

  Stronger extratropical storms
- There is no evidence for changes in hurricane frequency or intensity.

A most serious consequence of climate change during the past Century to the Gulf Coast environments is sea-level rise in response to melting of some polar ice and thermal expansion of warmer oceans (Muller and Grymes in Ning et al. 2000). The historical data suggested sea-level rise of about 12 cm (5 inches) over the last 100 years, and a much greater rise during the next 100 years. It must be stressed that for the Gulf Coast region these are very conservative estimates of local sea level rise, as continued deltaic and coastal subsidence is likely to

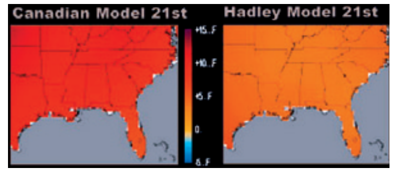

Figure 2. Observed precipitation changes during the last century are a patchwork of moderate increases and decreases. From NAST, 2002

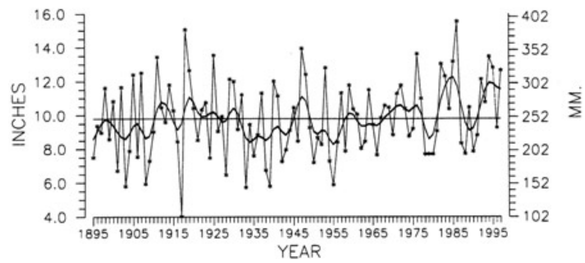

Figure 3. A time series of Oct-Dec average precipitation of the Gulf Coast region dating back to 1895. Note wetness during the 1990's. (From Crow and Quayle, 2000).

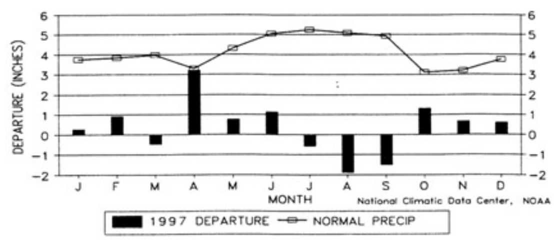

Figure 4. Gulf Coast region precipitation. Precipitation departures for 1997 from 1961–90 normals. The last three months wetness is consistent with El Nino projections. (From Crow and Quayle, 2000).

significantly enhance the apparent sea-level rise above global projections.

Sea-level rise has already had significant impacts on coastal areas and these impacts are very likely to increase (NAST, 2000). Between 1985 and 1995, southeastern states lost more than 32,000 acres of coastal salt marsh due to a combination of human development activities, sea-level rise, natural subsidence, and erosion. About 35 square miles of coastal land were lost each year in Louisiana alone from 1978 to 1990. Flood and erosion damage stemming from sea-level rise coupled with storm surges are very likely to increase in coastal communities.

Along with the change and variability in temperature and precipitation, the Gulf Coast region has also experienced change and variability in extreme weather events. For the past 10–20 years, this region

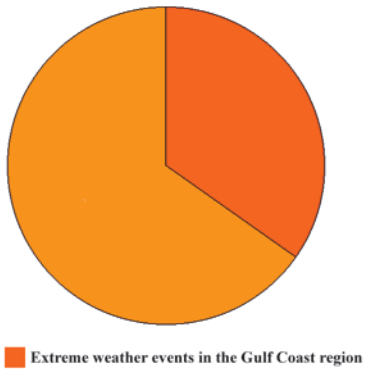

Figure 5a

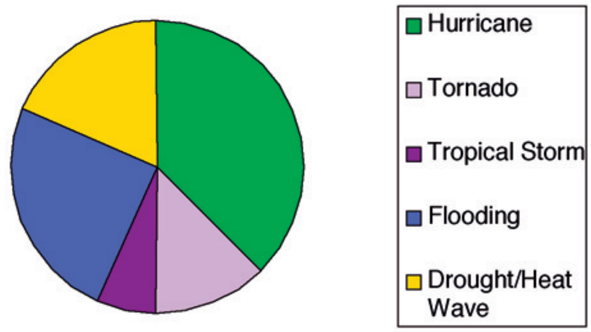

Figure 5b

Figure 5. Extreme weather events and disasters in the Gulf Coast region for the past 20 years. **5a,** among all extreme weather events in US, 34% of them happened in the gulf Coast Region. **5b,** types and frequencies of the extreme weather events in the Gulf Coast region. Based on the data from US Census Bureau, Statistic Abstracts 2001.

has experienced high frequency of weather related extreme events and disasters. The data of 1980–2000 (US Census Bureau, Statistical Abstracts 2001) indicated that of total 46 weather related extreme events and disasters occurred in US, 16 of them (34%) occurred in the Gulf Coast region, with 6 hurricanes, 4 flooding, 3 drought/heat wave, 2 tornado, and 1 tropical storm (Fig. 5 a and b).

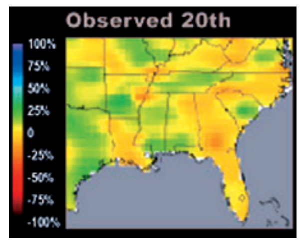

Figure 6. Scenario of the future temperature in the region. Model scenarios project relatively uniform increases in annually averaged temperatures. However, the Canadian model projects increases that are twice as large as the Hadley model. From NAST, 2000.

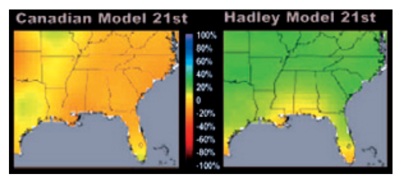

Figure 7. Scenario of the future precipitation in the region. The Canadian model scenario for the 21st century indicates near neutral trends or modest increases, while the Hadley model projects increases of near 25% for the region. From NAST, 2000.

5.3 Future Climate Scenarios

Climate has changed many times in the past, but the current rate of change seems to be large and there are enough similarities between observed changes and expected changes due to increased greenhouse gas. Based on climate perspectives studies and computer models of climate, it now seems probable that changes in regional weather patterns will accompany global warming (Karl et al., 1997). Longer and more intense heat could likely result in public health threats and increased heat-related mortality, as well as infrastructure stress like to electrical power outages and structural damage.

Climate change will also affect the patterns of precipitation, with some areas getting more and others less, changing global patterns and occurrences of droughts and floods. Similarly, increased variability and extremes in precipitation can exacerbate existing problems in water quality and sewage treatment and in erosion and urban storm-water routing, among others (Karl et al., 1997). Such possibilities underscore the need to understand the consequences of humankind's effect on climate.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next century. Both of the principal climate models used in the National Assessment project warming in the Gulf Coast by the 2090s, but at different rates (NAST, 2002). The Canadian model scenario shows the Southeast including the Gulf Coast region experiencing a high degree of warming, which translates into lower soil moisture as higher temperatures increase evaporation. The Hadley model scenario simulates less warming and a significant increase in precipitation (about 20%). Some climate models suggest that rainfall associated with El Niño and the intensity of droughts during La Niña phases will be intensified as atmospheric CO_2 increases (Fig. 6 and 7).

As the regional population and technology increase, the global average temperature is likely to

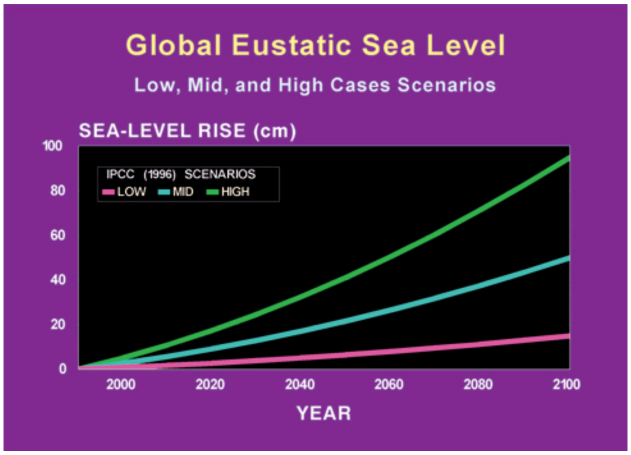

Figure 8. Eustatic sea-level rise projections for scenarios of low, moderate, and high cases based in IPCC 1996. From Doyle, 2002, in Ning et al. 2003.

rise an additional 1.0° to 3.5°C by the year 2100. The resulting sea level rise (Fig 8) could be devastating for coastal areas. Sea level rise is more dramatic than the global average along the Gulf Coast. The Hadley model predicted an average sea-level rise of 8.4 inches over next 100 years in the Gulf Coast region while the Canadian model predicted 15.6 to 19.2 inches. Coastal ecosystems and the services they provide to human society are likely to be negatively affected by sea level rise (NAST, 2000). Projected impacts are likely to include the loss of barrier islands and wetlands that protect coastal communities and ecosystems from storm surges, reduced fisheries productivity as coastal marshes and submerged grass beds are displaced or eliminated, and saltwater intrusion into surface and ground water supplies. The extent of the ecological impacts of sea-level rise is largely dependent upon the rate of rise and the development that has occurred along the shoreline. Other threats to these ecosystems come from changes in rainfall in coastal watersheds which are likely to alter fresh water inflows into estuaries, altering salinity patterns that determine the type and distribution of coastal plant and animal communities. There are few practical options for protecting natural ecosystems as a whole from increasing temperature, changes in precipitation, or rapidly rising sea level.

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